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APPLICATION
FOR
UNITED STATES LETTERS PATENT

TITLE: BEDDING SANITIZATION

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BEDDING SANITIZATION

BACKGROUND

[0001] This invention relates to an approach to, and a device for, sanitizing bedding.

[0002] After a guest of a hotel leaves, the linens (comprising the bed sheets and pillow slips) on the bed occupied by the guest are removed and replaced with freshly laundered linens in preparation for receiving the next guest. On the other hand, the heavier bedding – the pillows, blankets, and bedspreads – is normally cleaned only infrequently, typically by being sent out for drycleaning.

[0003] This same approach is used in hospitals, with linens of a bed being changed between patients, and heavier bedding being cleaned only infrequently, typically by drycleaning.

[0004] A drawback with this approach is that it compromises on the cleanliness of the bedding.

SUMMARY OF THE INVENTION

[0005] A user of a bed, particularly if ill, may impart germs not only to the linens, but also to the heavier bedding. In such a situation, if the heavier bedding is not cleaned between users, there is a risk that the next user of the bed may be exposed to these germs and possibly contract an illness.

[0006] Recognizing this problem, the present invention provides a method of operating a facility having beds which comprises, after departure of a user of a bed of the facility, removing used bedding from the bed. Bedding is irradiated with narrow spectrum radiation to obtain sanitized bedding and the bed is made up with the sanitized bedding. This method is suited for use with the heavier bedding.

[0007] The present invention also provides a sanitizer, comprising an irradiation chamber and at least one narrow spectrum light for emitting into the chamber. A bedding support is mounted for reciprocation within said chamber between a first terminal position proximate a base of the chamber and a second terminal position part way between the base of the chamber and a top of the chamber. With this arrangement and the top of the chamber acting as a backstop, the sanitizer is particularly suited for sanitizing pillows which may be placed on the bedding support and repeatedly compressed as the bedding support reciprocates.

[0008] In another aspect, the present invention provides a method of operating a multi-floor facility having beds. A portable sanitizer is brought to a floor of the multi-floor facility. After departure of a user of a bed in a room on the floor of the facility, the used heavier bedding is removed from the bed. The used bedding is then sanitized using the portable sanitizer to obtain sanitized bedding and the bed is made up with the sanitized bedding.

[0009] In a further aspect, a method of operating a facility having beds comprises, after departure of a user of a bed of the facility, removing used bedding from the bed. Bedding is sanitized in any suitable manner (i.e., by radiation or otherwise) to obtain sanitary bedding and the bed is made up with the sanitized bedding. A sign is placed on the bed indicating that the sanitized bedding has been sanitized. Again, this method is suited for use with the heavier bedding. In this regard, the sanitized bedding may include a pillow and the sign may comprise a band placed around the pillow.

[0010] Other features and advantages of the invention will become apparent from a review of the following description in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] In the figures which illustrate example embodiments of the invention,

[0012] FIG. 1 is a perspective view of a sanitizer made in accordance with this invention,

[0013] FIG. 2 is a partially broken away perspective view of the sanitizer of FIG. 1,

[0014] FIG. 3 is another partially broken away perspective view of the sanitizer of FIG. 1,

[0015] FIG. 4 is a top plan view of a portion of the sanitizer of FIG. 1,

[0016] FIG. 5 is a schematic bottom view of the sanitizer of FIG. 1,

[0017] FIG. 6A is an exploded perspective break out view of a portion of the sanitizer of FIG. 1,

[0018] FIGS. 6B and 6C are schematic side and top plan views of the portion of the sanitizer shown in FIG. 6A,

[0019] FIG. 7A and 7B are schematic views illustrating operation of the sanitizer of FIG. 1.

DETAILED DESCRIPTION

[0020] The present invention contemplates a method of operating a facility having beds. Such a facility could be a hotel, a hospital, or even an airplane where the seats of the plane act as beds for travellers. The method involves removing used bedding from a bed of the facility after departure of a user. The used bedding, or other bedding, is sanitized by irradiating the bedding with narrow spectrum radiation, such as ultraviolet ("UV") radiation. To provide more thorough sanitization, during the irradiation air may be circulated about the bedding. Additionally, if the bedding is compressible, the bedding may be repetitively compressed and relaxed during irradiation. The bed is made up with the sanitized bedding.

[0021] This approach is particularly suited to heavier bedding, such as blankets, pillows, and bedspreads, which is not amenable to regular laundering. So that the method may best ensure a healthy environment, used bedding may be replaced with sanitized bedding every time a new user of the bed departs. A user of the bedding may be assured of this healthier environment if, after making up the bed with the sanitized bedding, a sign is placed on the bed which indicates that the sanitized bedding has been sanitized. In this regard, where the

sanitized bedding includes a pillow, the sign may be in the form of a band placed around the pillow.

[0022] The repetitive compressing and relaxing of compressible bedding is particularly suitable where the bedding comprises pillows. In this regard, it may be helpful in dislodging germs from the pillows if they are compressed to about one-half their relaxed height.

[0023] Where the bedding comprises a blanket or a bedspread, sanitization may be facilitated by moving a narrow band radiation source (for example an ultraviolet light) along opposite sides of the blanket or bedspread at a stand-off from the blanket or bedspread. This may be accomplished by draping the blanket or bedspread over a supporting rod prior to exposing the bedding to narrow band radiation. In such instance, a narrow band radiation source may be moved under the rod.

[0024] Where the facility is a multi-floor building, such as a hotel or hospital, it may be more cost effective to implement the method with one or more portable sanitizers that may be deployed on each floor to receive and sanitize used bedding as it is removed from each bed. Bedding, once sanitized, may then be returned to the bed from which it was removed, or find its way onto another bed.

[0025] A suitable sanitizer to effect the described method for compressible bedding, such as pillows, is shown in the figures.

[0026] Turning to **FIG. 1**, a sanitizer **10** has a cabinet **12** with a tiltable lid **14** which, for reasons which will become apparent, acts as a backstop for bedding inside the sanitizer. The lid may have latching tabs **15** and opening handles **16**. The cabinet may be provided with a handle **17** and wheels **18** to make the sanitizer **10** portable. Two UV opaque windows **20a**, **20b** may be provided to allow viewing of irradiation chambers **22a**, **22b**, respectively, inside cabinet **12**. A butterfly valve **23** allows ambient air to be admitted into cabinet **12** when the ambient air pressure exceeds that inside the cabinet.

[0027] Turning to **FIGS. 2** and **4**, irradiation chamber **22b** is defined by four perforated walls **24** joined at their corners to form a box **26b** that is supported on the floor **28** of cabinet **12**. The walls **24** may be made of stainless steel. There is a gap **30** extending along each corner of box **26b** from the base of the box to approximately one-half the height of the box. A sleeve **32** extends along each corner of the box **26b** and is affixed to the cabinet floor **28** and box **26b** itself. With reference to **FIGS. 6A, 6B, and 6C** along with **FIG. 2**, each sleeve **32** houses a screw **34** that is partially threaded along its length. The screws **34** may be made of carbon steel alloy C-1045, which does not require lubrication.

[0028] With brief reference to **FIG. 5**, each screw **34** extends through floor **28** and terminates in a bevel gear **36**. Each face gear is driven by a motor **38b** through a series of bevel gears **40** and shafts **42**.

[0029] Each sleeve **32** has an axially directed cut out **46** extending from its base to approximately one-half the height of box **26b**. This cut out faces away from box **26b** and exposes the threads of screws **34**. An annulus **48** of a lifting assembly **44** surrounds each sleeve **32** and a tooth **50** fitted into a tube **52** extending from an annulus **48** engages the threads of a screw **34**. A cap **54** threaded onto the tube **52** retains the tooth **50** in position. An inwardly directed flange **56** extends from annulus **48** through a gap **30** in the corner of box **26b**.

[0030] The flange **56** of each of the four annuli **48** is joined to a corner of a perforated bedding support **60b**.

[0031] Referencing **FIG. 6B**, each of the four screws is threaded with a first spiral thread **62** and a second spiral thread **64** arranged to form a "figure-8" pattern along the screw. The first and second spiral threads **62, 64** meet at an inner end of the screw **34** at the top of cut out **46**, as seen in **FIG. 6B** and at the base of the screw (not shown).

[0032] The inner face of the walls **70** of cabinet **12** is high gloss and embossed. Walls **70** may be fabricated of aluminum. A first pair of UV lights **72b** extends between an end wall **70e** of cabinet **12** and an adjacent wall **24** of box **26b**. A further pair of UV lights **74b** extends between adjacent walls of box **26b** of irradiation chamber **22b** and box **26a** of

radiation chamber **22a**. The UV lights emit narrow spectrum radiation at a germicidal wavelength, e.g., 2,537 Angstroms.

[0033] A fan **78b** extends through floor **28** of cabinet **12** and forces air into a chimney **80** and through a side opening **82** (**FIG. 3**) of the chimney into the gap between the cabinet walls **70** and box walls **24**. Air deflectors **84** in walls **24** of box **26** deflect air flowing in the space between the cabinet walls **70** and the box walls **24** into the irradiation chamber **22b**.

[0034] Irradiation chamber **22a**, which is partially shown in **FIGS. 2** to **4**, is similarly configured.

[0035] Sanitizer **10** is suited for use in sanitizing compressible bedding, such as pillows. As such, turning to **FIG. 7A** along with the other figures assuming that the bedding supports **60a**, **60b** are in their lowermost positions (as illustrated in **FIG. 7A**) four pillows **90** may be placed into each irradiation chamber **22a**, **22b** with a perforated spacer **92** being placed between each pair of pillows. The lid **14** of sanitizer **10** may then be closed. Thereafter, UV lights **72a**, **72b**, **74a**, **74b** may be illuminated and motors **38a**, **38b** and fans **78a**, **78b** activated. With the motors activated, the shaft and bevel gear arrangement rotates face gears **36** and, therefore, each of screws **34** in the same rotational direction. This rotational direction is such that as a screw **34** rotates, its lifting assembly **44** moves upwardly along the first spiral screw thread **62**. Thus, the lifting assemblies of each of the four screws surrounding a bedding support act to lift the bedding support **60a**, **60b**. However, as the bedding support moves upwardly, as illustrated in **FIG. 7B**, the pillows are compressed between the bedding support and the lid **14**, which acts as a backstop.

[0036] Once the lifting assemblies reach the inner end of the threaded portion of screws **34** (which is part way between the base and top of the irradiation chamber at the top of the cut-out **46** of sleeves **32**), continued rotation of the motors causes the tooth of each lifting assembly to track the second spiral screw thread **64** of the screw **34**. In consequence, the lifting assemblies now move downwardly so that the lifting assemblies act to lower the bedding supports **60a**, **60b** until the bedding supports return to their lowermost position illustrated in **FIG. 7A**. At this point, the tooth of each lifting assembly begins again to track the first spiral screw thread **62** of the screw **34**. As a result, the bedding supports **60a**, **60b**

repeatedly reciprocate as the motors continue to rotate. The reciprocating supports and circulated air assist in ensuring the bedding inside the sanitizer does not overheat.

[0037] It will be apparent that with this arrangement, the bedding supports may be reciprocated by simply rotating the motors in one rotational direction. Of course, a less elegant alternative would be to replace the screws with ball screws and control the motors to switch rotational direction at each end of the stroke of the bedding supports.

[0038] The sleeve **32** around each screw, having a cut out **46** for tooth **50** which faces away from bedding support **60a**, **60b**, ensures that the bedding in each irradiation chamber is not snagged by the tooth or screw.

[0039] The stroke of the bedding supports may be such that the pillows are compressed to about one-half their relaxed thickness. As the pillows **90** are alternately compressed and relaxed, germs and particles trapped in the pillows are dislodged. All the while, fans **78a**, **78b** circulate air in the irradiation chambers **22a**, **22b**. The embossments of the inner surface of walls **70** of cabinet **12** impart turbulence to this circulating air. This turbulent air acts to dislodge loose particles on or in pillows **90**. Throughout, the UV lights emit UV radiation into the irradiation chambers which acts to neutralize germs (e.g., bacteria) exposed to the light.

[0040] The sanitation of the pillows in the sanitizer **10** may continue for a period of time in order to sufficiently sanitize the pillows. Thereafter, the UV lights may be extinguished and the motors and fans de-activated so that the lid **14** may be opened and the sanitized pillows removed.

[0041] The lid **14** of the sanitizer may have a control panel (not shown) used to control parameters of the sanitizer such as the period of sanitization.

[0042] The sanitizer **10** may be suitable for use with compressible bedding other than pillows, such as duvets. Where it is desired to sanitize less compressible bedding, a different type of sanitizer could be chosen. For example, in order to sanitize bedspreads or

blankets, the sanitizer described in Canadian patent application no. 2,335,398 may be used and the contents of this Canadian application are hereby incorporated by reference.

[0043] As an alternative to using UV light, far-infrared radiation may be used to sanitize the bedding in the sanitizer. In such instance, the bedding should be first wetted with a small amount of water. This technique is further described in U.S. publication number 2002 00 95946 published July 4, 2002, the contents of which are incorporated by reference herein. A drawback with this approach is that it may take considerable time to dry the bedding.

[0044] It is also recognised that for a multi-floor facility (such as a hotel or hospital) having beds, portable sanitizers for the heavier bedding (pillows, blankets, bedspreads) are beneficial, even where the sanitizers sanitize without using radiation.. Thus, a portable sanitizer (such as one on wheels) may be brought to a floor of the multi-floor facility. After departure of a user of a bed in a room on the floor of the facility, the used heavier bedding is removed from the bed. The used bedding is then sanitized using the portable sanitizer to obtain sanitized bedding and the bed is made up with the sanitized bedding.

[0045] It is further recognised that for a facility having beds, sanitizing of the heavier bedding (pillows, blankets, bedspreads) may be improved, even where sanitization occurs without using radiation.. More specifically, after departure of a user of a bed of the facility, used bedding is removed from the bed. Bedding is sanitized in any suitable manner (i.e., by radiation or otherwise) to obtain sanitary bedding and the bed is made up with the sanitized bedding. A sign is placed on the bed indicating that the sanitized bedding has been sanitized. The sanitized bedding may include a pillow and the sign may comprise a band placed around the pillow.

[0046] Other modifications will be apparent to those skilled in the art and, therefore, the invention is defined in the claims.